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Autistic symptoms in childhood arrestees: longitudinal association with delinquent behavior

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Background: To compare childhood arrestees with matched comparison groups on levels of autistic symptoms and to assess the unique predictive value of autistic symptoms for future delinquent behavior in childhood arrestees. **Methods:** Childhood first-time arrestees ($n = 308$, baseline age 10.7 ± 1.5 years) were followed up for 2 years. Autistic symptoms, externalizing disorders and delinquent behavior were assessed yearly. Childhood arrestees were compared on autistic symptoms with matched (age, gender) general population and clinical autism spectrum disorder samples. The predictive value of autistic symptoms for delinquent behavior was analyzed using generalized estimating equations. **Results:** At each assessment, levels of autistic symptoms in childhood arrestees were in between levels found in the general population and autism spectrum disorder samples. Autistic symptoms were positively associated with delinquent behavior in childhood arrestees, even after adjustment for externalizing disorders: IRR (incidence rate ratio) 1.23; 95% CI 1.11–1.36 and IRR 1.29; 95% CI 1.15–1.45 for core autistic symptoms and total symptom score, respectively. **Conclusions:** Autistic symptoms are more prevalent in childhood arrestees compared to the general population and are uniquely associated with future delinquent behavior. Attention should, therefore, be given to the possible presence of autism related symptomatology in these children. Implications for diagnostic assessment and intervention need further investigation. **Keywords:** Pervasive developmental disorder, delinquency, externalizing disorder, longitudinal study.

Introduction

An association between autism spectrum disorder (ASD) and offending has long been suggested (Howlin, 2004; Vermeiren, Jaspers, & Moffit, 2006). However, studies investigating this association are scarce and evidence predominantly comes from theoretical contributions and case studies (e.g. Haskins & Silva, 2006; Milton, Duggan, Latham, Egan, & Tantam, 2002). Elevated levels of ASD symptomatology have been found in specific offender groups (Anckarsater, Nilsson, Saury, Rastam, & Gillberg, 2008; Siponmaa, Kristiansson, Jonson, Nyden, & Gillberg, 2001; 't Hart-Kerkhoffs et al., 2009). Studies comparing people with ASD with healthy controls did, however, not find higher rates of (violent) offending in autistic persons (Mouridsen, Rich, Isager, & Nedergaard, 2008; Woodbury-Smith, Clare, Holland, & Kearns, 2006). Whether autistic symptoms are predictive of future offending in general offender groups, particularly when taking into account preexisting behavioral problems, has not yet been established.

Autism spectrum disorder is a childhood neuro-developmental disorder characterized by severe and persistent impairments in communication and social interaction, combined with repetitive and stereotyped patterns of behavior, interests and activities (American Psychiatric Association, 2000). It is suggested, mainly from studies in adult populations, that specific features of ASD may comprise susceptibility to displaying behavioral problems and (severe) offending. For example, violence may result from lack of social understanding as well as from restrictive understanding of the implications of certain behaviors for others. Rigidity or the pursuit of obsessive interests could also lead to problems with rules (Howlin, 2004; Mouridsen et al., 2008; Woodbury-Smith et al., 2005). Conversely, rigidity and restricted patterns of interests and activities could also act as factors preventing antisocial and law breaking behavior (Mouridsen et al., 2008). Some individuals with ASD may thus engage in antisocial and delinquent behavior while others may show less 'unwanted' behavior relative to the general population.

Newman and Ghaziuddin (2008) and Palermo (2004) hypothesized that an association between

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ASD and offending does not so much result directly from ASD symptomatology itself, but rather from co-occurring disorders. Externalizing disorders are highly prevalent in juvenile offenders (for reviews, see Fazel, Doll, & Langström, 2008; Vermeiren et al., 2006), as well as in children with ASD (de Bruin, Ferdinand, Meester, de Nijs, & Verheij, 2007; Simonoff et al., 2008). Furthermore, there may be some overlap in symptomatology between the disorders. In support of this idea are studies demonstrating social cognition, emotion recognition and pragmatic language impairments, commonly associated with ASD, to also occur in children with disruptive behavior or externalizing disorders (Donno, Parker, Gilmour, & Skuse, 2010; Gilmour, Hill, Place, & Skuse, 2004; Jones, Forster, & Skuse, 2007; Trentacosta & Fine, 2010). However, whether autistic symptoms contribute to offending or the persistence of antisocial behavior, over and above externalizing disorders, has not yet been investigated.

At present, research on this topic is solely cross-sectional and has mainly focused on severe and violent offending in specific offender groups, for example juvenile or adult homicide and sex offenders (e.g. Scragg & Shah, 1994; Silva, Leong, & Ferrari, 2004; 't Hart-Kerkhoffs et al., 2009). Although relevant from both a scientific and clinical perspective, it still remains unknown whether autistic symptoms are a common problem for the much larger group of less severe offenders. Therefore, we will focus on a group of childhood first-time offenders. While committing mainly minor offenses, this group is at risk of developing a persistent pattern of offending of increasing seriousness (Loeber, Slot, van der Laan, & Hoeve, 2008; Moffitt, 1993; van Domburgh, Vermeiren, Blokland, & Doreleijers, 2009). High levels of mental health problems, including externalizing disorders, have furthermore been found in childhood offenders (van Domburgh, 2009). In addition, the advantage of studying childhood offenders over older offender populations is the greater availability of specific information from parents or care takers, allowing more reliable assessment of psychopathology (Colins, Vermeiren, Schuyten, Broekaert, & Soye, 2008). To our knowledge, this is the first study to look into the relation between autistic symptoms and offending over time in this specific population.

In sum, systematic research investigating a possible association between ASD and offending is scarce and findings are equivocal. The aim of this study is therefore twofold. First, to assess the level of autistic symptoms, using a dimensional measure, in childhood arrestees compared to children from the general population and children diagnosed with ASD at three consecutive assessments over a 2-year follow-up period. Second, to investigate the predictive value of autistic symptoms for delinquent behavior over time in childhood arrestees, and the possible mediating effect of co-occurring externalizing disorders.

The use of a dimensional measure for autistic symptoms allows detailed evaluation of the association with delinquent behavior and exploration of this association for various symptoms of ASD.

Methods

Subjects

Childhood arrestees. Subjects were 308 children arrested by the police prior to age 12 because of a first-time offence. In this study, children are called arrestees, even when they were not taken to the police station but only reprimanded on the spot (van Domburgh et al., 2009). As 12 years is the age of criminal responsibility for Dutch law, these children cannot be prosecuted. Subjects were selected in the period from 2003 to 2005 from local police registration systems of three police districts in The Netherlands, thereby assuring sufficient variability in socio-economic status (SES) and levels of urbanization of the neighborhoods the children resided in. Offending was defined as behavior that could be prosecuted if displayed by someone aged 12 years or older, excluding status offenses. Out of 422 potential participants and their parents who consented to be contacted by the research team, 27.0% ($n = 114$) did not participate in the study. Children who refused participation did not differ from participants on age and seriousness of first arrest, but were more often female (21.1% vs. 12.7%; $\chi^2 = 4.554$, $df = 1$, $p = .033$), of non-Dutch origin (65.8% vs. 51.0%; $\chi^2 = 7.174$, $df = 1$, $p = .007$) and more often lived in neighborhoods with low SES (68.4% vs. 52.6%; $\chi^2 = 8.494$, $df = 1$, $p = .004$).

Subjects were followed up for 2 years after first arrest and were assessed yearly from baseline onwards. Mean times between baseline and follow-up assessments were 1.1 ± 0.3 and 2.2 ± 0.4 years, respectively. Follow-up data were available for 76.3% ($n = 235$) of the initial sample. Mean ages were 10.7 ± 1.5 years at baseline, and 11.8 ± 1.5 and 12.9 ± 1.5 at the two follow-up assessments, respectively. Of the baseline sample 86.4% ($n = 266$) was male and 54.4% ($n = 167$) of the sample was of non-Dutch origin. Children were considered to be of non-Dutch origin in case they or (one of) their parents were born in a country other than the Netherlands (Heeten & Verweij, 1993). Mean IQ of the children was 88.3 ± 14.9 estimated by the block design and vocabulary subtests of the Wechsler Intelligence Scale for Children-Revised (WISC-R; Wechsler, 1974; Sattler, 1982). Complete Children's Social Behavior Questionnaire (CSBQ) data were available for $n = 273$, $n = 243$ and $n = 224$ children, respectively, for the consecutive assessments and were compared to CSBQ scores of children from the general population and children diagnosed with ASD. Baseline CSBQ scores as well as age, sex, seriousness of first arrest, ethnicity and SES of their neighborhoods did not differ between participants who completed all assessments and those who dropped out during follow-up.

All participating children and parents gave written informed consent. This study was approved by the Medical Ethical Committee of the VU University Medical Center and the Dutch Justice Department.

Comparison groups. At each assessment, childhood arrestees were compared to a group of general population children matched for age and gender ($n = 840$, $n = 1,134$ and $n = 1,057$ for the consecutive assessments, respectively). The normal matched groups came from (a) a sample of children who participated in the CSBQ normative study of 2,507 general population children recruited through regular schools in the Netherlands (Hartman, Luteijn, Moorlag, de Bildt, & Minderaa, 2007) and (b) from a sample of children who participated in a large representative study of children with mental retardation (de Bildt, Sytema, Kraijer, & Minderaa, 2005). Since a lower IQ may covary with severity of problems from the autism domain (Wing, 1997), we combined children from these two samples (two thirds from the normal population; one third borderline or mild mental retardation) to approximate the IQ distribution found in our childhood arrestee sample (also approximately two thirds above and one third below 80).

At each assessment, the childhood arrestees were further compared to an age and gender matched group of children with an ASD diagnosis ($n = 209$, $n = 213$ and $n = 185$ for the consecutive assessments, respectively). Children with an ASD diagnosis were patients that either visited the outpatient clinic for child and adolescent psychiatry in Groningen, the Netherlands or took part in the aforementioned sample of children with mental retardation (de Bildt et al., 2005). DSM-IV classifications were made by child and adolescent psychiatrists through extensive diagnostic procedures. Again we ensured that one third of these patients had known IQs within the borderline to mild mental retardation IQ range along with similar age and gender distributions to maximize similarity with the childhood arrestee group.

Instruments

Autistic symptoms. Symptoms of ASD were measured using the 49-item CSBQ (Hartman, Luteijn, Serra, & Minderaa, 2006). The questionnaire is filled in by parents and items are scored on a 3-point scale. The CSBQ consists of six subscales reflecting various developmental and social problem areas seen in children with ASD, particularly in its milder forms (Hartman et al., 2006):

Not tuned	Measures children's adaptation to social situations; 11 items
Social	Measures children's abilities regarding social contact, social interest and social reciprocity; 12 items
Orientation	Measures orientation in time, place, or activity and the ability to keep an overview of tasks and situations; eight items
Understanding	Measures children's understanding of rules of communication and the social use of language; seven items
Stereotyped	Measures stereotypical behavior like odd movements with fingers and hands or smelling of objects; eight items
Change	Measures fear of and resistance to changes; three items

The subscales *social*, *understanding*, *stereotyped* and *change* reflect core symptoms of ASD as described in DSM-IV-TR (American Psychiatric Association, 2000). Behaviors from the subscales *orientation* and *not tuned* are less specific for children with ASD and also occur to a great extent in children with attention deficit hyperactivity disorder (ADHD) and oppositional defiant disorder (ODD). A composite core symptom score was therefore created by summing the scores of the *social*, *understanding*, *stereotyped* and *change* subscales. The CSBQ has good psychometric properties with regard to test-retest and interrater reliability, internal consistency of the subscales and good validity (de Bildt et al., 2009; Hartman et al., 2006; Luteijn, Luteijn, Jackson, Volkmar, & Minderaa, 2000). The CSBQ, particularly the core symptom subscales, distinguishes well between autism, pervasive developmental disorder-not otherwise specified (PDD-NOS) and ADHD, and compares well to the Autism Diagnostic Interview-Revised (ADI-R) and Autism Diagnostic Observation Schedule, and clinical DSM-IV-TR classifications in children with intellectual disability (de Bildt et al., 2009; Hartman et al., 2006). In addition, CSBQ scores are associated with scores on the Autism Behavior Checklist and relevant subscales of Theory-of-Mind ability (Blijd-Hoogewys, van Geert, Serra, & Minderaa, 2008; Hartman et al., 2007). Reliability of the CSBQ was also good in the group of childhood arrestees with Cronbach's alphas of .95, .94 and .95, respectively, for the consecutive assessments.

Delinquent behavior. Delinquent behavior was measured combining the child and parent versions of the Observed Antisocial Behavior Questionnaire (Slot, Orobio de Castro, & Duivenvoorden, 1998). This instrument is a Dutch revision of the Self-Report of Antisocial Behavior Scale which is a reliable instrument to assess children's antisocial behavior (Loeber, Stouthamer-Loeber, van Kammen, & Farrington, 1989). It contains 17 items on delinquent behavior, regarding violence (hitting or fighting outside the home or use of a weapon; six items), theft (stealing outside the home; five items), vandalism (property damage or arson; four items) and rule breaking (nuisance or fare dodging; two items). Parent and child self-report were combined into a single score, with an item being present if reported by either one of the informants, conforming with procedures applied by the authors of the questionnaire (Loeber, Stouthamer-Loeber, & van Kammen, 1998). Scores on all items were then summed into a total score reflecting the extent of delinquent behavior (range 0–17). Delinquent behavior was reported over the previous 6 months at baseline assessment and reported over the previous 12 months at follow-up assessments.

Externalizing disorders. The sections on ADHD, ODD and conduct disorder (CD) of the parent version of the NIMH Diagnostic Interview Schedule for Children (DISC; Shaffer et al., 1996; Verhulst, van der Ende, Ferdinand, & Kasius, 1997) were used to assess the presence of externalizing disorders in the childhood arrestee group. Validity of the DISC is moderate to good (Schwab-Stone et al., 1996). DISC data were available for 82.7% of the participants. Missing data were mainly due to language difficulties.

Statistical analyses

First, analyses of variance with post hoc Bonferroni correction were performed in SPSS 17.0 (Chicago, Illinois, USA) to compare CSBQ scores between childhood arrestees and general population and ASD comparison groups. Effect sizes (Cohen's *d*) were calculated for the differences between the groups. Effect sizes of .20–.49 were considered small, of .50–.79 were considered medium, and > .80 were considered large (Cohen, 1988).

Second, generalized estimating equations (GEE) were used to investigate the association between autistic symptoms and delinquent behavior over time in the childhood arrestee group. This procedure is suitable for analyzing irregularly spaced longitudinal data and makes use of all available data of subjects (Zeger & Liang, 1986), also in case of incomplete follow-up. Dependence of repeated measures within one person is accounted for by using a working correlation structure. GEE analyses were performed in STATA 11.0 (College

Table 1 Mean Children's Social Behavior Questionnaire (CSBQ) scores of childhood arrestees over time and matched comparison groups

	Time	Childhood arrestees (<i>M</i> ± <i>SD</i>)	NC (<i>M</i> ± <i>SD</i>)	δ^a	ASD (<i>M</i> ± <i>SD</i>)	δ^b	ANOVA <i>F</i> (<i>df</i>) <i>p</i> Value	Post hoc
Not tuned	T0	7.5 ± 6.0	4.5 ± 4.4	.60	10.8 ± 5.8	-.55	139.7 (1320) < .01	— ^{cd}
	T1	6.9 ± 5.7	4.4 ± 4.4	.53	10.9 ± 5.8	-.70	171.6 (1586) < .01	— ^{cd}
	T2	6.0 ± 5.6	4.2 ± 4.3	.40	11.0 ± 5.9	-.87	162.1 (1462) < .01	— ^{cd}
Social	T0	3.3 ± 3.9	1.9 ± 2.8	.48	8.1 ± 4.9	-1.10	272.7 (1317) < .01	— ^{cd}
	T1	3.0 ± 3.7	1.9 ± 2.9	.37	8.1 ± 4.8	-1.19	304.6 (1584) < .01	— ^{cd}
	T2	3.3 ± 4.3	1.9 ± 2.9	.43	8.4 ± 4.8	-1.12	272.7 (1461) < .01	— ^{cd}
Orientation	T0	3.6 ± 3.7	2.2 ± 2.9	.45	6.4 ± 3.7	-.77	148.2 (1317) < .01	— ^{cd}
	T1	3.4 ± 3.5	2.1 ± 2.9	.44	6.2 ± 3.6	-.80	167.1 (1582) < .01	— ^{cd}
	T2	2.8 ± 3.3	1.8 ± 2.7	.34	6.4 ± 3.7	-1.03	185.6 (1462) < .01	— ^{cd}
Understanding	T0	3.8 ± 3.3	2.5 ± 2.8	.47	7.0 ± 3.9	-.88	178.7 (1317) < .01	— ^{cd}
	T1	3.7 ± 3.1	2.5 ± 2.8	.39	6.7 ± 4.0	-.86	169.1 (1584) < .01	— ^{cd}
	T2	3.0 ± 3.1	2.5 ± 2.8	.17	7.0 ± 4.1	-1.13	175.6 (1461) < .01	— ^d
Stereotyped	T0	2.3 ± 2.7	1.1 ± 1.8	.58	3.6 ± 3.3	-.44	108.9 (1319) < .01	— ^{cd}
	T1	1.9 ± 2.6	1.0 ± 1.8	.47	3.5 ± 3.4	-.53	119.6 (1587) < .01	— ^{cd}
	T2	1.8 ± 2.5	0.9 ± 1.6	.51	3.4 ± 3.5	-.54	119.1 (1462) < .01	— ^{cd}
Change	T0	0.9 ± 1.5	0.8 ± 1.3	.07	3.0 ± 2.0	-1.25	200.8 (1315) < .01	— ^d
	T1	0.8 ± 1.6	0.8 ± 1.2	.06	2.9 ± 2.0	-1.16	207.1 (1584) < .01	— ^d
	T2	0.8 ± 1.6	0.7 ± 1.2	.11	2.9 ± 2.0	-1.18	204.0 (1460) < .01	— ^d
Core symptoms	T0	10.4 ± 9.3	6.2 ± 6.9	.55	21.8 ± 11.0	-1.13	300.8 (1318) < .01	— ^{cd}
	T1	9.5 ± 8.4	6.2 ± 6.9	.45	21.3 ± 11.4	-1.19	323.1 (1584) < .01	— ^{cd}
	T2	8.9 ± 9.5	6.0 ± 6.7	.40	21.7 ± 11.6	-1.23	307.2 (1461) < .01	— ^{cd}
Total CSBQ	T0	21.4 ± 17.1	12.9 ± 12.6	.61	38.9 ± 17.4	-1.02	274.2 (1318) < .01	— ^{cd}
	T1	19.8 ± 15.6	12.7 ± 12.5	.54	38.3 ± 17.9	-1.11	306.5 (1584) < .01	— ^{cd}
	T2	17.7 ± 16.6	12.0 ± 12.2	.43	39.0 ± 18.4	-1.23	296.8 (1461) < .01	— ^{cd}

NC, general population children; ASD, children diagnosed with autism spectrum disorder.

^aEffect sizes Cohen's *d* childhood arrestees compared to NC. ^bEffect sizes Cohen's *d* childhood arrestees compared to ASD.

^cSignificant difference between NC and childhood arrestees, *p* < .01. ^dSignificant difference between childhood arrestees and ASD, *p* < .01.

Station, Texas, USA), using exchangeable correlation structures. First, crude analyses were performed with repeated measures of delinquent behavior as the dependent variable and baseline autistic symptoms as the independent variable. Due to the Poisson distribution and overdispersion of the delinquent behavior data, negative binomial GEE was used. In the analyses, age at baseline, sex, ethnicity and low IQ were controlled for by adding them to the model as time-independent covariates. Second, to take into account possible mediating effects of externalizing disorders, adjusted analyses were run by adding externalizing disorders to the crude model as a categorical variable. *p* Values < .05 were considered statistically significant in all analyses.

Results

Autistic symptoms in childhood arrestees

At each assessment, all but one of the CSBQ (sub)-scores of childhood arrestees were in between those of the matched general population and ASD samples (Table 1). At baseline and 1-year follow-up, childhood arrestees had significantly higher scores than children from the general population on core symptoms, the total symptom score and all subscales, except for the subscale *change*. At 2-year follow-up, these groups did not differ with regard to the *understanding* and *change* subscales. Childhood arrestees scored significantly lower than children diagnosed with ASD on all CSBQ scores, both at baseline and follow-up assessments.

Cohen's *d* in the table represent the mean difference between childhood arrestees and comparison groups expressed in pooled standard deviations. These effect sizes for childhood arrestees versus the normal control group were medium at baseline and small at follow-up; for childhood arrestees versus ASD children, they were medium to large at all assessments.

Autistic symptoms in relation to self-reported delinquent behavior over time

The results of the longitudinal regression analyses are presented in Table 2. The incidence rate ratios

(IRRs) are the exponents of the regression coefficients and represent the magnitude and direction of the association between standardized CSBQ scores and delinquent behavior over time. The IRR is the factor with which delinquent behavior changes with an 1-*SD* difference in CSBQ score.

The results of the crude analyses showed all CSBQ scores to significantly predict delinquent behavior at follow-up. The association with delinquent behavior was strongest for the total symptom score and weakest for the *change* subscale score.

Externalizing disorders were present at baseline in 33.2% of the childhood arrestees. The predictive value of CSBQ scores for future delinquent behavior was partially mediated by co-occurring externalizing disorders. This was represented by decreasing IRRs when crude analyses were adjusted for externalizing disorders (Table 2). CSBQ scores remained significantly associated with delinquent behavior, except for the *change* subscale. The association with delinquent behavior was again strongest for the total symptom score.

Discussion

This study compared the presence of autistic symptoms between childhood first-time arrestees and children from the general population as well as children diagnosed with ASD at three yearly consecutive assessments. In addition, the predictive value of autistic symptoms for delinquent behavior over 2-year follow-up was assessed in childhood arrestees, adjusting for the effect of co-occurring externalizing disorders. Results showed childhood arrestees to have more autistic symptoms than children from the general population and less than autistic individuals. Furthermore, autistic symptoms were uniquely positively associated with future delinquent behavior in these children. Although mediated by co-occurring externalizing disorders, autistic symptoms predicted delinquent behavior over and above externalizing disorders.

This study's main limitation is that ASD was not clinically diagnosed in our sample. Because autistic

Table 2 Longitudinal negative binomial regression of standardized Children's Social Behavior Questionnaire (CSBQ) scores at baseline on delinquent behavior over 2-year follow-up in childhood arrestees

	Crude model ^a			Adjusted model ^b		
	<i>N</i>	IRR (95% CI)	<i>p</i> Value	<i>N</i>	IRR (95% CI)	<i>p</i> Value
Not tuned	250	1.44 (1.27–1.63)	< .001	227	1.22 (1.07–1.39)	.003
Social	249	1.37 (1.23–1.52)	< .001	226	1.21 (1.09–1.34)	< .001
Orientation	250	1.39 (1.25–1.55)	< .001	227	1.20 (1.05–1.36)	.006
Understanding	251	1.37 (1.24–1.52)	< .001	228	1.19 (1.05–1.35)	.006
Stereotyped	250	1.25 (1.12–1.39)	< .001	227	1.12 (1.00–1.25)	.041
Change	250	1.24 (1.11–1.39)	< .001	227	1.07 (0.96–1.20)	.211
Core symptoms	249	1.42 (1.29–1.57)	< .001	226	1.24 (1.12–1.38)	< .001
Total CSBQ	250	1.48 (1.33–1.66)	< .001	227	1.30 (1.16–1.46)	< .001

IRR, incidence rate ratio.

^aModel corrected for age at baseline, sex, ethnicity and low IQ. ^bCrude model adjusted for externalizing disorders: ADHD, DBD or ADHD + DBD.

symptoms were measured dimensionally by means of a questionnaire, we cannot conclude that there is a definite association between ASD as a *disorder* and delinquent behavior. Our findings thus indicate that future research on this issue should be extended to include clinical diagnoses, using (semi)structured interviews, as well. Nevertheless, this study is the first to investigate the longitudinal association between autistic symptoms dimensionally and delinquent behavior in young offenders, adjusted for co-occurring externalizing disorders. It thereby adds to the growing literature on the association between social-communicative impairment and delinquency and our findings have important implications.

Our results show that, besides elevated rates of externalizing disorders (van Domburgh, 2009), autism related symptoms also occur at increased rates in childhood arrestees, compared to normal children, both initially and over 2-year follow-up. This is in accordance with cross-sectional studies demonstrating elevated rates of (symptoms of) ASD in various offender populations (Anckarsater et al., 2008; Siponmaa et al., 2001; Hart-Kerkhoffs et al., 2009). The variability in CSBQ scores in our group of childhood arrestees, may indicate that a small but substantial subset of children experiences significant dysfunctioning due to autistic symptomatology. Conversely, the majority of childhood arrestees probably showed few autistic symptoms, resembling the general population. This is consistent with observed heterogeneity among childhood arrestees, with only a minority of these children continuing their deviant behavior and experiencing mental health and associated problems (Moffitt, Caspi, Harrington, & Milne, 2002; van Domburgh et al., 2009). Alternatively, the CSBQ scores in childhood arrestees may be a reflection of limited understanding of social situations and the consequences of actions, resulting from less well developed social cognitive abilities. Deficits in these abilities, such as pragmatic language, emotion recognition and empathy, are not necessarily specific to autism, but have also been observed in relation to antisocial behavior (Blair & Coles, 2000; Donno et al., 2010; Jones et al., 2007).

The decreasing difference in autistic symptoms between arrested children and the general population sample over time may be explained by attenuation, as is often seen in longitudinal studies (Duan, Alegria, Canino, McGuire, & Takeuchi, 2007). This phenomenon may even be reinforced in childhood arrestees. In addition to being a stressful event, a police contact may well have raised parent's awareness of their children's behavior, potentially resulting in overreporting of problems at baseline. Childhood arrestees resembled children from the general population with regard to the *change* subscale. A possible explanation relates to anxiety, which is likely to be related to the symptoms of fear

or resistance to change. Childhood arrestees, already having demonstrated problem behavior, are likely to be more daring than children diagnosed with ASD, who frequently experience symptoms of anxiety (de Bruin et al., 2007; Simonoff et al., 2008). This may indicate that among ASD children, the less anxious individuals are more likely to offend.

Autistic symptoms were predictive for future delinquent behavior in childhood arrestees. Again, the core autistic symptom score was strongly associated with delinquent behavior, comparable to the total symptom score. The association found can thus not solely be explained by the less specific symptoms regarding unadjusted behavior and other behavioral problems that are not core to autism. This was further confirmed by the unique prediction of autistic symptoms of later delinquent behavior, over and above the presence of externalizing disorders. Correcting for the effect of co-occurring externalizing disorders in the association between autistic symptoms and delinquent behavior, may, however, not exclude an effect of overlapping social cognitive impairments related to ASD and antisocial behavior. However, several studies have shown that, although social cognitive impairments occur both in ASD and antisocial behavior, the nature of these impairments may differ. For instance, with regard to empathy, deficits in cognitive and motor empathy are mainly associated with ASD, while deficits in emotional empathy are mainly associated with antisocial behavior (Blair, 2005; Jones, Happe, Gilbert, Burnett, & Viding, 2010). Our findings may thus indicate specific impairments and associated features, related to ASD, to comprise vulnerability for offending in children with ASD, as previously theorized (Howlin, 2004; Mouridsen et al., 2008; Woodbury-Smith et al., 2005). However, as this could not be determined from the present study, the specific mechanisms through which autistic symptoms exert their effect on delinquent behavior should be further investigated.

Given our findings, consideration should be given to autistic symptoms potentially being present in childhood arrestees. Because autism-related symptomatology was measured dimensionally, no firm conclusions can be drawn on the prevalence of autistic disorder as defined by DSM. Still, whether or not related to an actual ASD diagnosis, effective recognition of autism-related problems is important, as these could cause considerable impairment and may warrant specific intervention. The CSBQ can be a useful instrument to detect social-communicative deficits in childhood arrestees, as well as in screening procedures to determine whether more extensive diagnostic assessment for ASD is warranted. In addition, scores on the various subscales may guide specific intervention. Further research is needed to elucidate the complex

association between ASD and offending and related mechanisms, and to determine whether ASD-screening in juvenile offenders is needed and may affect their outcome.

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Key points

- Although systematic research is scarce, case studies and elevated levels of autism (symptoms) in offender populations suggest an association between ASD and offending.
- It is unknown whether such association might solely be explained by autistic features or result from co-occurring externalizing disorders and shared symptomatology between those disorders and ASD.
- In childhood arrestees, more autism symptoms are present than in matched general population children. Moreover, those symptoms uniquely predict future delinquent behavior in these children, irrespective of the presence of externalizing disorders.
- Autism-related features may thus predispose to delinquent behavior in childhood arrestees, calling for specific attention for autistic symptoms in diagnostic procedures in these children, and further research into this association.

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